UNITED STATES DEPARTMENT OF THE INTERIOR
U. S. - MEXICO BORDER FIELD COORDINATING COMMITTEE

WATER-RESOURCES ISSUES IN THE LOWER RIO GRANDE VALLEY--BELOW FALCON RESERVOIR TO THE GULF OF MEXICO SUBAREA

Fact Sheet

INTRODUCTION

In 1994, the U.S. Department of the Interior (DOI) chartered the U.S.-Mexico Border Field Coordinating Committee (FCC) for the purpose of promoting and facilitating coordination among the DOI Bureaus on environmental issues of Departmental interest along the U.S.-Mexico border. One of the foremost issues identified was that of shared-water resources. Subsequently, a multi-bureau Shared-Water Resources Issues Team was created to identify, compile, and communicate significant issues related to the shared-water resources of the U. S.-Mexico border area. Woodward and Durall (1996), as part of the Issues Team, used surface-water drainage basins as the primary basis for defining and delineating the extent of the border area from a shared-water resources perspective, and divided the border area into 8 subareas (fig. 1). This Fact Sheet presents shared-water resource issues in the Lower Rio Grande Valley from below Falcon Reservoir to the Gulf of Mexico from a DOI perspective. The continued importance of border resource issues to DOI is evidenced by its recent participation in the development of the Border XXI Program. Border XXI represents a conceptual plan for binational cooperation in the transboundary region (U.S. Environmental Protection Agency, 1996a).

WATER-RESOURCES ISSUES IDENTIFICATION

The Issues Team surveyed representatives of the various DOI Bureaus to identify significant management and scientific issues associated with shared-water resources in each subarea. The Issues Team acknowledges a number of deficiencies in the issue-identification process, in that all of the land owners/managers in the subareas were not surveyed: (1) issues were not identified for non-Federal lands, including those managed by the State of Texas or those privately owned, and (2) issues have been identified only for the U.S. portion of the subarea, and a comprehensive issue-identification process requires data from Mexico. These deficiencies notwithstanding, the Issues Team has identified a large number of the most pressing issues associated with shared-water resources from a DOI perspective. Solicitation of additional input from the States of Texas, Nuevo Leon, and Tamaulipas; the Government of Mexico; and private land-owners would enhance future efforts to more completely identify shared-water resource issues in the border area.

LOWER RIO GRANDE VALLEY--BELOW FALCON RESERVOIR TO THE GULF OF MEXICO SUBAREA

The Lower Rio Grande Valley subarea (fig. 2) is physiographically characterized as Gulf Coastal Plain. The subarea contains 10 basins that drain either to the Rio Grande (in Mexico, this river is called Rio Bravo), to the lower reaches of the Rio San Juan, or to the Arroyo Colorado in southern Texas (fig. 6). This subarea encompasses a total of 10,240 square miles-- of which 6,155 are in Mexico and 4,085 are in the United States. Unlike most of the other U.S.-Mexico border subareas, a relatively small portion (approximately 174 square miles) of this reach is under the ownership or administration of the U.S. Federal Government. Federally owned or managed areas include the Santa Ana, Lower Rio Grande Valley, and Laguna Atascosa National Wildlife Refuges (NWR) administered by the U.S. Fish and Wildlife Service and the Palo Alto Battlefield National Historic Site (fig. 6) administrated by the National Park Service. Although not specifically residing in the Lower Rio Grande Valley, issues pertinent to the National Park Service's Padre Island National Seashore are also discussed in this Fact Sheet.

From Falcon Reservoir, the Rio Grande/Rio Bravo flows southeastward approximately 275 river miles, terminating in the coastal wetlands and marshes of the Gulf of Mexico--including the Laguna Madre off the coasts of Texas and Tamaulipas. Among the unique habitats of this segment of the U.S.-Mexico border are the *resacas* (oxbow lakes) of the Lower Rio Grande Valley. The subarea is classified as Tamaulipan brushland, which is characterized by dense, woody, and thorny vegetation and a high degree of biological diversity. Vegetation is taller and more lush in riparian areas than in the dryer uplands and provides not only important nesting and feeding habitat, but also serves as corridors for

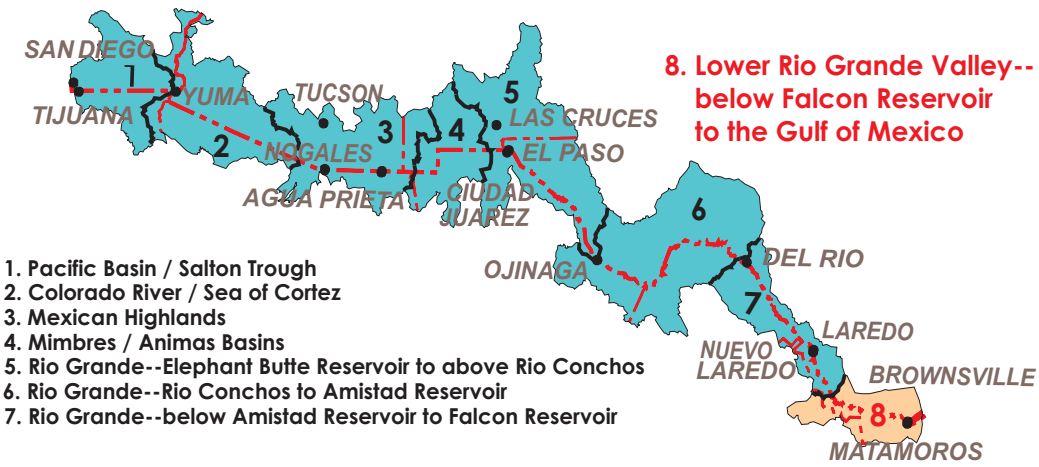


Figure 1. Subareas within the U.S. - Mexico border area.

animal movement. The subarea receives considerably more rainfall than most other subareas of the border, with an average annual rainfall of about 26 inches at the mouth of the river and about 16 inches at Falcon Dam. In Texas, the primary population centers are McAllen, Harlingen, and Brownsville; Reynosa and Matamoros are the major cities in Tamaulipas (fig. 6). The total 2000 population of these cities is estimated to be in excess of 1,500,000. As in other border subareas, the water resources and associated plant, fish, and wildlife communities of the Lower Rio Grande Valley are increasingly subject to the pressures of human activities.

SIGNIFICANT WATER-RESOURCE ISSUES

Limited water quantity and impaired water quality represent the greatest water-resources issues in the subarea. Anthropogenic activities such as agriculture, urbanization, and industry compete for and affect both the quantity and quality of the water resources. Water withdrawal and use has reduced water quantity and quality, resulting in significant threats to the biological, cultural, and physical resources of the Lower Rio Grande Valley subarea. In the remainder of this Fact Sheet, these threats are discussed under the general headings of water quantity and water quality, Though in many situations, water quantity and water quality are directly related.

Water Quantity

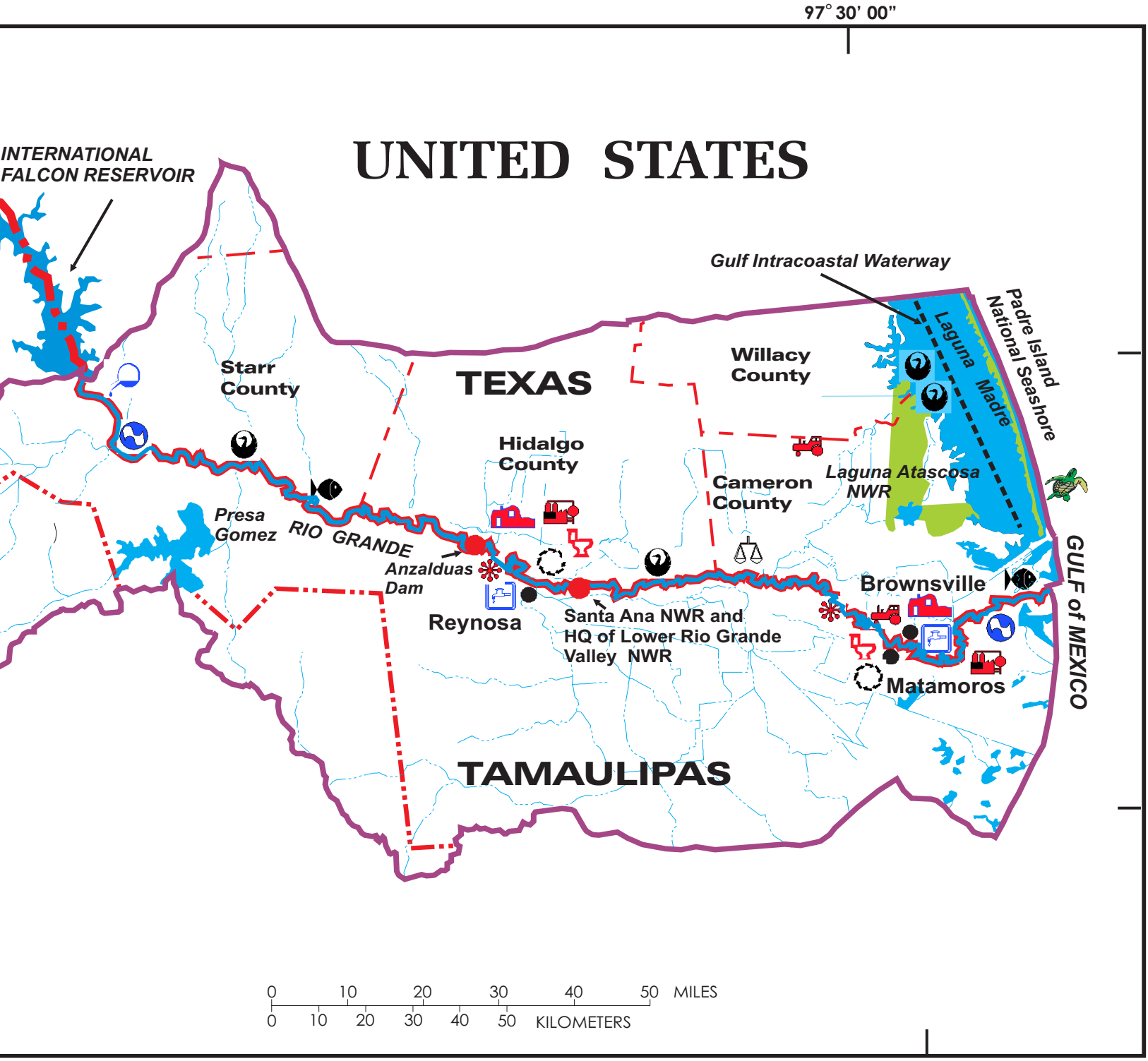
Surface-water flow entering the Lower Rio Grande Valley subarea via the Rio Grande mainstem is greatly influenced by water-management practices and upstream control structures . Mexico's Rio Conchos and Rio San Juan have been the primary sources of water for this section of the Lower Rio Grande for several decades. Flow in these rivers is being rapidly diminished by increasing demands in their upper watersheds. The Rio Conchos supplies many cities in northwestern Mexico, while

EXPLANATION

The following icons (symbols) are used in the text and in Figure 2 to describe a variety of water issues; a brief explanation of each symbol is provided below.

- Water quantity issues
- Municipal or domestic water supply
- Ground water - surface water interaction
- Maintenance of river flows
- Riparian / wildlife habitat issues
- Fish impacts
- Legal issues / water rights
- Agricultural chemical / nutrient runoff
- Salinity
- Human population pressure
- Chemical/industrial effluent
- Undertreated sewage
- Endangered species (sea turtles)

Figure 2. Water issues in the Lo



Lower Rio Grande Valley--below Falcon Reservior to the Gulf of Mexico subarea.

EXPLANATION

- Federal lands
- Boundary of subarea

Monterrey--Mexico's second largest city--is drawing much of the Rio San Juan's water.

Within the subarea, the rapidly growing cities of Reynosa, McAllen, Brownsville, and Matamoros are placing increasing demands on the Rio Grande for freshwater. Ground water is usually not a suitable alternative water source for these urban areas due to high salinity, and elsewhere in the subarea there is concern that increased future water demands could exacerbate the problem due to salt-water encroachment into the aquifer. Within the subarea, a high percentage of the surface-water supply is presently allocated to agriculture, and increased municipal and industrial demands are raising concerns as to whether sufficient water supplies will be available during dry periods.

Surface flow in the Rio Grande below Falcon Reservoir is highly controlled. Falcon Reservoir, which is the most downstream of the major international storage reservoirs, was authorized for construction by the U.S.-Mexico Water Treaty of 1944. The reservoir has a storage capacity of about 2.7 million acre-feet and a maximum storage capacity of about 4 million acre-feet. Much of the water released from the reservoir is diverted during April, May, and June to satisfy irrigation needs. Average diversions during January through June exceed the total annual flow in the Rio Grande at Brownsville. Water for use in the United States is diverted along the river by local irrigation districts and stored in holding ponds. Most of the water for use in Mexico is diverted at Anzalduas Dam (fig. 6).

The most downstream tributary to the river is located 10 miles west of Mission, TX (fig. 6). A low ridge extends from the southern edge of the upland plain near Mission in Hidalgo County, preventing runoff in the area north of the ridge from flowing to the river. Much of the eastern part of the valley is drained by small coastal streams, the Arroyo Colorado, *resacas*, and drainage ditches that flow into the Laguna Madre. Two floodways, constructed by the International Boundary and Water Commission (IBWC) to receive excess floodwater, dissect the valley. A small portion (less than 10 percent) of the water withdrawn for irrigation is returned to the Rio Grande. The Arroyo Colorado carries much of the natural drainage and irrigation-return flows to the Laguna Madre just north of the Laguna Atascosa. Much of the drainage from the northeastern parts of the study area are carried to the Laguna Madre by the Raymondville Drain (fig 6). As a result of these diversions, the Rio Grande itself delivers only a portion of water in the subarea to the Gulf.

The principal flow to the Laguna Atascosa National Wildlife Refuge is through the Cayo Atascoso (fig 6). The Cayo Atascoso flows into Laguna Atascosa, which is the largest lake on the refuge (fig 6). The Cayo Atascoco continues past the northern side of the refuge and ultimately discharges into the Arroyo Colorado. Although the Cayo Atascoso continues past Laguna Atascosa, sediment has been deposited near the outlet of the laguna to such an extent that it can no longer be completely drained. The refuge also receives agricultural drainwater through the Resaca de los Cuates (fig. 6).

Ground water in the area is obtained from the Gulf Coast aquifer system of Texas and is produced in small volumes from Eocene-age strata and the Miocene-age Oakville Sandstone. Moderate to large volumes come from the Evangeline and Chicot aquifers (part of the Gulf Coast aquifer system) in Cameron, Hidalgo, and Willacy Counties. These aquifers are hydraulically connected and function as a unit (Baker and Dale, 1961). Water levels in the area have declined dramatically since the 1950's due to irrigation pumpage and severe drought. In 1985, the total pumpage of ground water in the Lower Rio Grande Valley was 17,268 acre-feet. Total surface-water use was 824,250 acre-feet. Surface water has been, and will continue to be, the most important source of water supply for the subarea.

Of particular concern to DOI Bureaus is the continued availablility of water for habitat and wildlife management purposes. The four southernmost counties of Texas have one of the highest diversities of plants and animals in the continental U.S. which sustains eco-tourism in south Texas and northeastern Mexico. Seven of the 11 biotic communities in these counties are riparian or partially riparian. Additionally, the extreme lower section of the river supports a very diverse estuarine community and serves as a valuable nursery area for sport and commercial species of shrimp, crabs, and fish.

The Santa Ana, Lower Rio Grande Valley, and Laguna Atascosa NWR in this subarea provide habitat to a wide variety of species, and serve as important wintering and production habitat for migratory waterfowl and neotropical birds. The U.S. Fish and Wildlife Service also is actively purchasing land easements and water rights in the Lower Rio Grande Valley to form the Rio Grande Valley Wildlife Corridor in an attempt to preserve, restore, and integrate what remains of the unique Tamaulipan brushland habitat. The Corridor now includes about 64,000 acres of federally managed land.

Palo Alto Battlefield National Historic Site, north of Brownsville, commemorates the causes and consequences of the Mexican-American War from both the Mexican and the United States perspectives. While the landscape at the time of the 1846 battle contained a number of *resacas (fig. 3)*, many were later modified by livestock operations, agriculture, drainage, road building, and other activities. A long-term goal of the National Park Service is to eventually restore a portion of the historic landscape in order to both interpret the importance of these wetland features in determining troop movements during the battle and to preserve their natural-resource values.

The natural resources under protection in the Lower Rio Grande Valley are closely associated with both the coastal estuary systems and the flows of the Rio Grande and its associated floodplain wetland systems. Maintenance of many of these wetland resources, in particular the *resacas*, requires a natural cycling of flood events, which no longer regularly occurs in the system due to water-management practices.

Figure 3. Example of *resaca* habitat.

Increased municipal and agricultural demands for water have significantly decreased the quantity of water available for refuge wetlands. Additionally, agricultural systems and water-control structures now intercept overland flow that historically inundated much of the river floodplain. Annual average flow in the lower part of the Rio Grande has been reduced by 30 percent to 50 percent by water diversions, and over the past 30 years several fish species have disappeared from the river. Additionally, river-dependent natural stands of plants such as the Sabal Palm and the Montezuma Bald Cypress have been reduced to remnant numbers. Securing adequate water allocation for the management of these wetland and riparian habitats represents a major challenge.

Figure 4. Irrigation return flows.

Water Quality

In addition to reduced water quantities, degraded water quality is a serious concern throughout the Lower Rio Grande Valley subarea. Under-treated sewage, agricultural return flows, and industrial pollution are the most frequently cited concerns. Loss of freshwater flow has exacerbated these pollution problems.

Agricultural chemicals (insecticides, herbicides, and fertilizers) are used year-round in the Lower Rio Grande Valley, and many of these chemicals accumulate in sediment upon reaching aquatic environments. The Arroyo Colorado and other agricultural drains route potentially harmful amounts of agricultural, municipal, and industrial contaminants to the Laguna Madre, a sensitive, shallow estuary with little water exchange with the Gulf of Mexico. The proximity of agricultural land to refuges in the subarea and the importance of the region as a migratory bird flyway increases the potential for adverse impacts on wildlife. Additionally, irrigation of salt-bearing soil common to the region often results in high dissolved-solids concentration in the return flows. Increased salinity in the Rio Grande negatively impacts native fish species and contributes to the invasion of exotics, such as the salt-tolerant blue tilapia, which is now the dominant river fish species in the Brownsville area. Increased salinity also threatens use of water resources for agriculture and human consumption. The culture of marine and estuarine organisms, a new and expanding industry in the region, is an additional source of concern in terms of the potential for contaminant and nutrient input to the Arroyo Colorado and the Laguna Madre, as well as the threat of introduction of non-native species and their associated diseases.

The chemical quality of ground water over most of the study area is poor. Dissolved solids usually range from 1,000 to 5,000 mg/l, with sodium, chloride, and sulfate dominating the hydrochemistry. Additionally, high boron and nitrate concentrations appear to be widespread throughout the area. In general, the ground water is unsuitable for irrigation without practicing special agricultural techniques (McCoy, 1990).

Urbanization and economic development in the subarea has increased municipal and industrial use of water resources. The increase in industrial activity not only increases consumptive use of water, but also raises concerns over aquatic pollution. Heavy metals, industrial solvents, and petroleum products represent common concerns. Additionally, in many areas, water-treatment infrastructure has not kept pace with increased urban growth. The population increase has resulted in expansion of the size and number of unincorporated subdivisions that often lack adequate sewage-treatment systems .

In addition to the important resources directly associated with the Lower Rio Grande Valley, this subarea also contains two unique coastal resources. The Laguna Madre and Padre Island National Seashore (fig.6) are unique areas that are of major importance to biological diversity. The Laguna Madre of Texas extends the entire length of the South Texas coast from Corpus Christi Bay to the Mexican border. The Laguna is unusual in being one of the few hypersaline lagoon systems in the world. Laguna Madre supports extensive seagrass meadows that are extremely valuable aquatic nursery areas. Additionally, the Laguna Madre in Texas and Tamaulipas provides wintering grounds for 75 percent of the world population of redhead ducks (Marc Woodin, USGS,

personal commun., 2002). The redheads feed almost exclusively on a particular type of seagrass *Halodule* while in residence. However, this species of seagrass has suffered a 30 percent reduction in recent years. Turbidity associated with maintenance dredging in the Gulf Intracoastal Waterway and the recurrence of brown tide (an extensive phytoplankton bloom) have been implicated in the seagrass decline (Chris Onuf, USGS, personal commun., 2002).

Padre Island National Seashore, which separates the Laguna Madre from the Gulf of Mexico, is the longest undeveloped barrier island in the United States. The National Seashore contains extensive marine, estuarine, and wetland communities including salt marshes, ephemeral ponds, and wind tidal flats that provide critically important habitat for more than 300 bird species and five species of threatened or endangered sea turtles . Padre Island is also the site of a successful binational recovery program for the endangered Kemp's Ridley sea turtle (fig. 5). The species' only other major nesting site is near Rancho Nuevo in Mexico. Threats to the water quality of the area include oil and gas development, potential spills resulting from transportation of oil and hazardous materials, impacts of dredging, and the deposition of marine debris along the Gulf beaches. Because of the local currents, the shoreline along the Gulf of Mexico is heavily impacted by trash that is washed ashore from a variety of sources, including commercial shrimping, oil and gas production, and shipping activities (Miller and others, 1995). Oil spills have also periodically damaged areas along both the Gulf of Mexico and Laguna Madre. There exists the possibility of opening up the lower Laguna Madre south of the international border to barge traffic, thus allowing the increased transport of hazardous materials along the National Seashore's western side.

Figure 5. Kemp's Ridley sea turtle.

Figure 6. Generalized hydrologic infor
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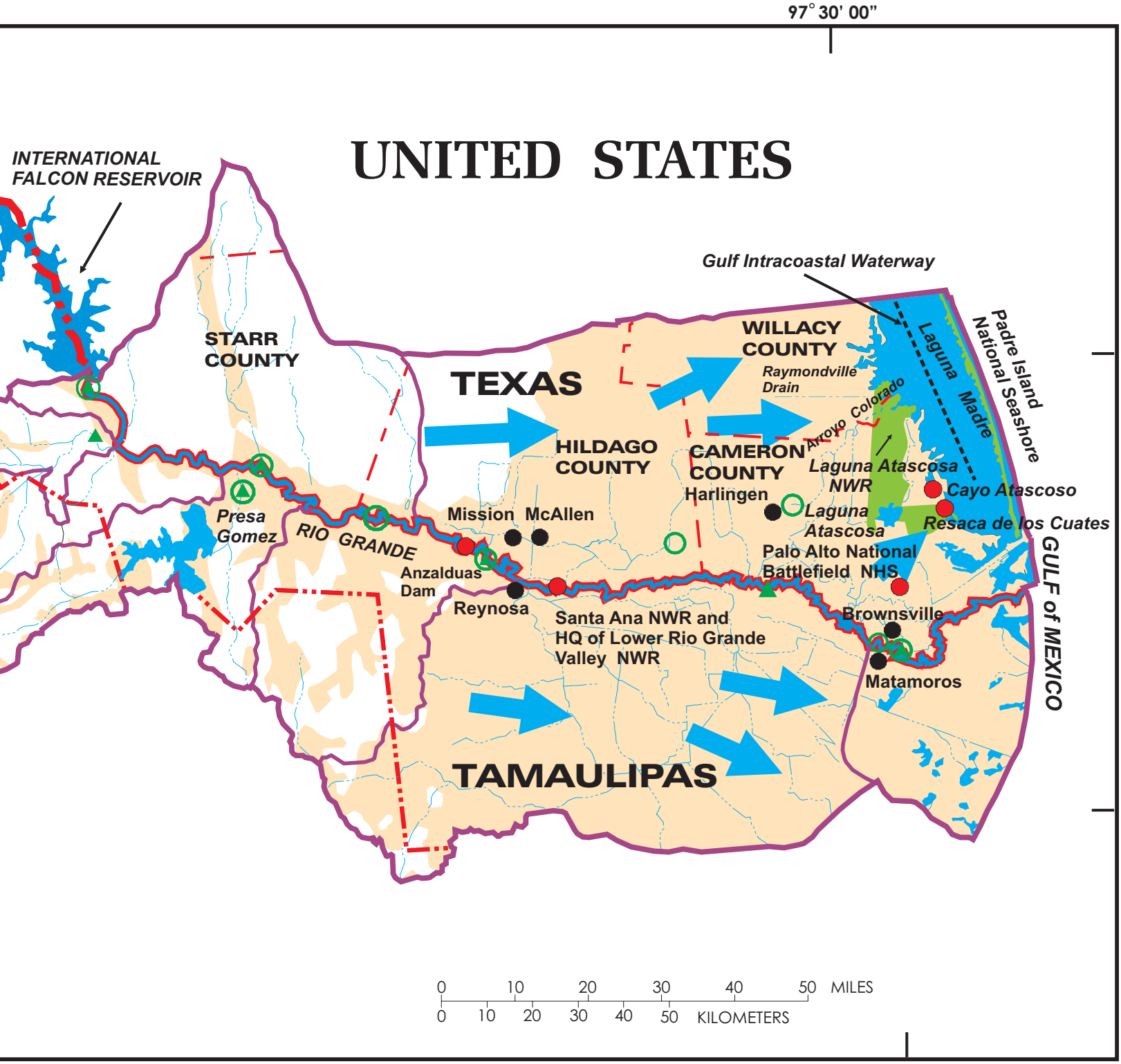

ormation in the Lower Rio Grande Valley--below Falcon
xico subarea.

EXPLANATION

- Unconsolidated aquifer
- Direction of generalized ground-water flow
- Boundary of subarea
- Active discharge station
- Active water-quality station
- Cited locations
- City

CONSIDERATIONS FOR FUTURE ACTION

Water resources are critical to the health of the communities and the environment along each side of the border within the Lower Rio Grande Valley subarea. Although the Rio Grande/Rio Bravo serves to define the international boundary, it also plays an important role in unifying the historical and cultural context of the region (Los Caminos del Rio Heritage Project Task Force, 1994). The management of this important resource, as well as the equitable resolution of present and future conflicts, is of concern to DOI Bureaus with responsibilities in this and adjacent subareas. Therefore, continued cooperation among the DOI Bureaus is necessary to understand and appropriately interact with the Government of Mexico, as well as other Federal, State, and local entities and citizen's groups in order to address the many complex issues relating to the shared-water resources of the region. Important regional goals include implementing solutions to improve water conservation, addressing water-quality and contaminant issues, protecting the viability of local recreational opportunities, and protecting the remaining riparian habitat and the species dependent upon them.

Suggested actions from the DOI perspective include:

- promoting public awareness of the importance of water resources and the value of aquatic and riparian environments of the Lower Rio Grande Valley subarea;
- managing DOI lands in a manner to minimize adverse impacts on water resources and maximize biological integrity, recreational opportunity, and enhancement of habitat for water-dependent flora and fauna;
- developing an improved understanding of existing water uses and the effects of those uses on threatened and endangered species, riparian habitat, biodiversity maintenance, and other water-dependent resources;
- facilitating increased cooperation and collaboration among the Government of Mexico; the States of Tamaulipas, Nuevo Leon, and Texas; the IBWC; Native American Tribes; and the DOI Bureaus in addressing transboundary water issues affecting lands managed by DOI; and
- ensuring that sufficient water-quantity, water-quality, and biological data are readily available for accessing current conditions and for detecting changing water resource status and trends.

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